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UK ABWR

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UK ABWR Generic Design Assessment

Other Environmental Regulations

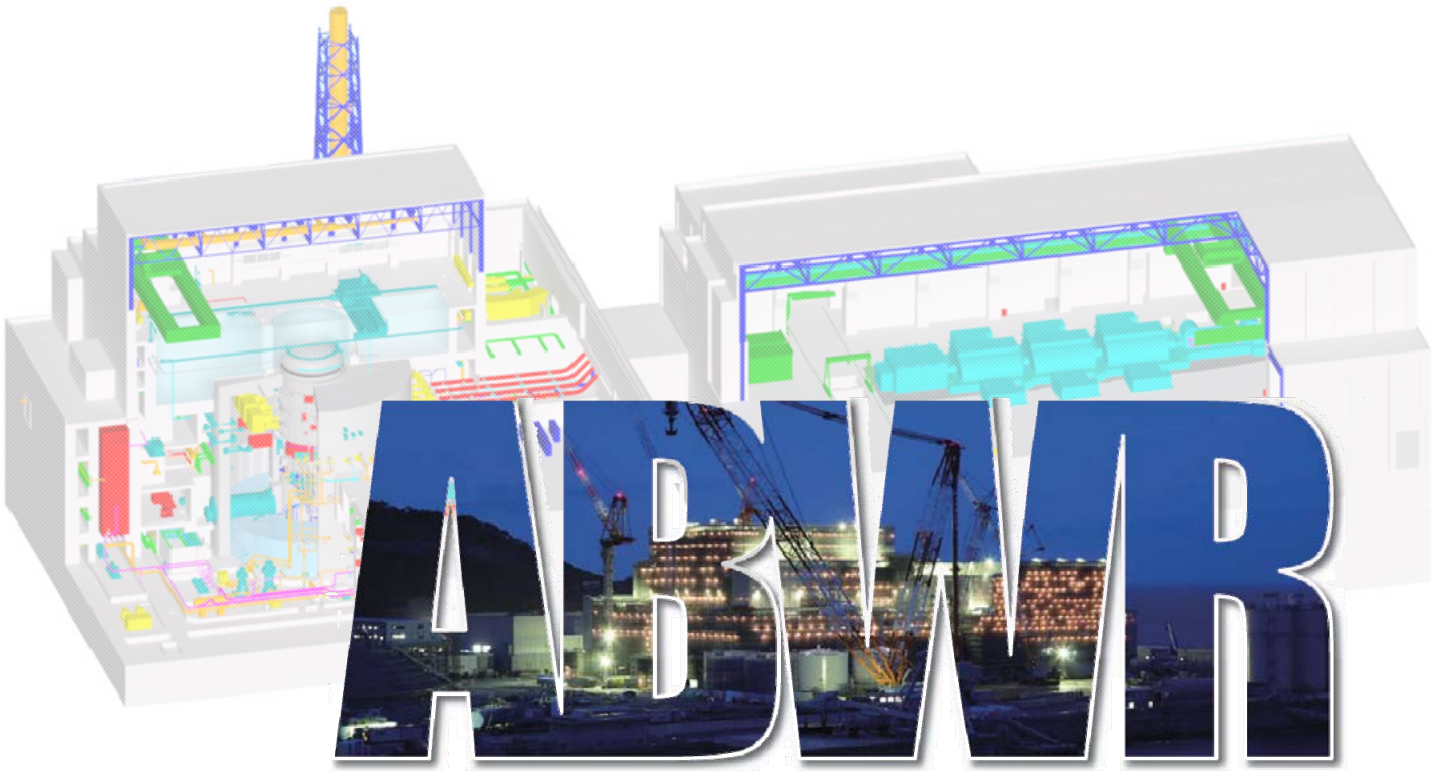

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Table of Contents

1. Acronyms

ABWR	Advanced Boiling Water Reactor
AC	Atmospheric Control System
ALARA	As Low As Reasonably Achievable
ALARP	As Low As Reasonably Practicable
BAT	Best Available Technique
BPEO	Best Practicable Environmental Option
BPM	Best Practicable Means
Bq	Becquerel
BSS	Basis Safety Standards Directive
BWR	Boiling Water Reactor
C&I	Control and Instrumentation
CAD	Controlled Area Drain
CCI	Commercially confidential information
CD	Condensate Demineraliser
CDL	Calculated Detection Limit
CF	Condensate Filter
COMAH	Control of Major Accident Hazards
CONW	Concentrated Waste System
CP	Corrosion Product
CSG	Combustion Sector Guidance Note
CST	Condensate Storage Tank
CUW	Reactor Water Clean-up System
CW	Circulating Water System
CWP	Circulating Water Pump
D/W	Dry well
DAW	Dry Active Waste
DCD	Design Control Document
DECC	Department of Energy and Climate Change
DEFRA	Department for Environment, Food and Rural Affairs
DF	Decontamination Factor
DORIS	The marine dispersion model used in PC-CREAM 08®
DPUR	Dose Per Unit Release
EIA	Environmental Impact Assessment

EMCLs	Environmental Media Concentration Limits
EPR/EPR10	Environmental Permitting (England and Wales) Regulations 2010
EQS	Environment Quality Standards
ERICA	Environmental Risk from Ionising Contaminants: Assessment and Management
ESE	Environmentally Sensitive Equipment
EU	European Union
f-value	Fuel leakage rate
F/D	Filter-Demineraliser
FAP	Forward Action Plan
FDP	Funded Decommissioning Programme
FDW	Feedwater System
FP	Fission Product
FPC	Fuel Pool Cooling and Clean-up System
GDA	Generic Design Assessment
GDF	Geological Disposal Facility
GEP	Generic Environmental Permit
GNF	Global Nuclear Fuel
GSD	Generic Site Description
HAW	Higher Activity Waste
HCEP	How to comply with your environmental permit
HCW	High Conductivity Waste System
HEPA	High Efficiency Particulate Air Filter
HFE	Human Factors Engineering
HFF	Hollow Fibre Filter
HLW	High Level Waste
HNCW	HVAC Normal Cooling Water System
HOP	Hydrazine, oxalic acid, potassium permanganate
HS	Heating Steam System
HSCR	Heating Steam and Condensate Water Return System
HSD	Hot Shower Drain
HSE	Health and Safety Executive (UK)
HVAC	Heating Ventilation and Air Conditioning system
HWC	Hydrogen Water Chemistry
I&C	Instrumentation and Control
IA	Instrument Air System
IAEA	International Atomic Energy Agency

ICRP	International Commission on Radiological Protection
IEX	Ion-exchange (demineraliser) system
ILW	Intermediate Level Waste
IPPC	Integrated Pollution Prevention and Control
IRA	Initial Radiological Assessment
IWS	Integrated Waste Strategy
KK-6	Kashiwazaki-Kariwa Nuclear Power Station Unit 6
KK-7	Kashiwazaki-Kariwa Nuclear Power Station Unit 7
LCW	Low Conductivity Waste System
LD	Laundry Drain System
LLW	Low Level Waste
LLWR	Low Level Waste Repository
LoC	Letter of Compliance
LOCA	Loss of Coolant Accident
LPRM	Local Power Range Neutron Monitor
LS	Laundry System
LWR	Light Water Reactor
MCERTS	Monitoring Certification Scheme
MS	Main Steam System
NDA	Nuclear Decommissioning Authority
NHS	Non Human Species
NMCA	Noble Metal Chemical Addition
NPP	Nuclear Power Plant
NRW	Natural Resources Wales
NUREG	Nuclear Regulatory Commission Regulation (US)
OG	Off-gas
ONR	Office for Nuclear Regulation
OSPAR	Oslo and Paris Convention on Protection of the Marine Environment of the North East Atlantic
P&D	Plumbing and Drainage System
P&ID	Process and Information Document for Generic Assessment of Candidate Nuclear Power Plant Design
P/C	Power Centre
PCI	Pellet Cladding Interaction
PCSR	Pre-Construction Safety Report
PI	Personal Information
ppb	Parts per billion

PWR	Pressurised Water Reactor
QA	Quality Assurance
QAP	Quality Assurance Plan
QC	Quality Control
QMP	Quality Management Plan
QMS	Quality Management System
R/B	Reactor Building
RCLEA	Radioactively Contaminated Land Exposure Assessment
RCW	Reactor Building Cooling Water System
REP	Radioactive Substances Regulation – Environmental Principle
RGP	Relevant Good Practice
RP	Requesting Party
RPDP	Radiation Protection Developed Principle
RQ	Risk Quotient
RSA	Radioactive Substances Act
RSR	Radioactive Substances Regulation
RSW	Reactor Building Service Water System
RW/B	Radwaste Building
RWMA	Radioactive Waste Management Arrangement
RWMD	Radioactive Waste Management Directorate
S/B	Service Building
S/P	Suppression Pool
SA	Station Service Air System
SAM	Sampling System
SAP	Safety Assessment Principle
SF	Spent Fuel
SFAIRP	So Far As Is Reasonably Practicable
SFP	Spent Fuel Pool
SGTS	Standby Gas Treatment System
SJAE	Steam Jet Air Ejector
SLC	Standby Liquid Control System
SoDA	Statement of Design Acceptability
SPCU	Suppression Pool Clean-up System
SQEP	Suitably Qualified and Experienced Person (UK)
SRNM	Start-up Range Neutron Monitor
SS	Spent Sludge System

Sv	Sievert
T/B	Turbine Building
TIP	Traversing In-core Probe
TCW	Turbine Building Cooling Water System
TSW	Turbine Building Service Water System
TV	Tank Vent Treatment System
UF	Uncertainty Factor
UK	United Kingdom
US	United States
VLLW	Very Low Level Waste
WENRA	Western European Nuclear Regulators' Association

2. References

1 Process and Information Document for the Generic Assessment of Candidate nuclear power plant Designs, version 2, March 2013, Environment Agency.

2 Water Resources Act 1991, GB Parliament, 1991.

3 The Eels (England and Wales) Regulations 2009, (SI 2009 No. 3344), The Stationery Office.

4 Water Resources (Abstraction & Impounding) Regulations 2006 (SI2006, No.641), The Stationery Office.

5 Council of the European Union, EC Council Regulation (1100/2007) Establishing measures for the recovery of the stock of European eel, 2007.

6 Salmon and Freshwater Fisheries Act 1975, GB Parliament, 1975.

7 Integrated Pollution Prevention and Control Reference Document on the Application of Best Available Techniques to Industrial Cooling Systems, European Commission, Seville, December 2001.

8 Cooling Water Options for the New Generation of Nuclear Power Stations in the UK, SC070015/SR, Environment Agency June 2010.

9 Generic Site Description, GA91-9901-0020-00001, XE-GD-0095, Rev C, Hitachi-GE, March 2014.

10 Environmental Permitting Regulations (England and Wales) Regulations 2010 (SI 2010 No.675), The Stationery Office.

11 Horizontal Guidance Note H1 annex D, Basic surface water discharges (version 2.2) Bristol: Environment Agency, 2011.

12 European Parliament and Council of European Union, 2008. Directive on the environmental quality standards in the field of water policy (2008/105/EC). Official Journal of the European Union, L 348, 84-97.

13 Demonstration of BAT, GA91-9901-0023-00001, XE-GD-0097, Rev C, Hitachi-GE, March 2014.

14 Environmental Permitting (England and Wales) (Amendment) Regulations 2013 (SI 2013 No.390), The Stationery Office.

15 Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control) (Recast) OJ No. L334, 17.12.2010, p 17

16 European Commission, 2003, Directive 2003/87/EC of the European Parliament and of the Council establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (OJ L 275, 25.10.2003, p. 32).

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18 Environment Agency, 2009. How to comply with your environmental permit, Additional guidance for: Combustion Activities (EPR 1.01). Bristol: Environment Agency.

19 Environment Agency. How to comply with your environmental permit, Document 433_11 (Version 5) Bristol: Environment Agency.

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21 The Control of Major Accident Hazards Regulations 1999, Statutory Instrument 1999 No. 743. London: The Stationery Office.

22 The Control of Major Accident Hazards (Amendment) Regulations 2005, Statutory Instrument 2005 No. 1088. London: The Stationery Office.

3. Introduction

The Environment Agency has identified the information they require to assess the environmental impacts of the UK ABWR at a generic site in the Process and Information Document for the Generic Assessment of Candidate nuclear power plant Designs (P&ID) (1).

Table 1, part 8 of the P&ID details the information Hitachi-GE are required to provide regarding the applicability and impact of other environmental regulations on the design and generic site. The areas in question relate to the non-radioactive regulations, specifically:

- Water use and abstraction;
- Discharges to surface waters;
- Discharges to groundwater;
- Operation of installations (combustion plant and incinerators); and,
- Substances subject to the Control of Major Accident Hazards Regulations.

Within this submission, Hitachi-GE have summarised the applicability of regulations in each of these areas and have established Hitachi-GE's proposed approach to address the P&ID requirements in future GDA submissions. In doing so, the Environment Agency's information requirements contained in Table 1, part 8 within the P&ID will be met in subsequent submissions. The actual assessments will be undertaken in Step 2 of the GDA.

4. Water Use and Abstraction

4.1. P&ID Requirements

The Environment Agency has identified the information they require to carry out the GDA in the P&ID (1). The P&ID requirements relating to water use and abstraction are reproduced below:

1. *Provide details and estimates of fresh water requirements for the design.*
2. *Provide details and estimates of cooling water requirements for the design relevant to the generic site. Include consideration of:*
    - *seawater or river water abstraction;*
    - *use of conventional cooling towers or hybrid cooling towers;*
    - *abstraction inlet fish deterrent schemes;*
    - *fish return systems.*

4.2. Regulatory context

There are two main areas of legislative requirements relevant to this section of the P&ID:

- Water abstraction – regulated under the Water Resources Act 1991 (as amended) (2);
- The Eels (England and Wales) Regulations 2009 (3).

Water abstraction from controlled waters is regulated under the Water Resources Act 1991 (as amended) (2), Part II, Chapter II, and the Water Resources (Abstraction & Impounding) Regulations 2006 (4). A licence is required from the Environment Agency or Natural Resources Wales (NRW) in Wales to impound water or to abstract over 20m^3/day water from a river or stream, reservoir, lake or pond, canal, spring, underground source or estuary, bay or arm of the sea. Abstraction licensing is a site-specific issue.

The Eels (England and Wales) Regulations 2009 implement EC Council Regulation (1100/2007) (the EC Eel Regulation) (Eels Regulations) (5). This regulation requires the operator of an abstraction or water diversion of more than 20 cubic metres a day, or any discharge to a channel, bed or sea (out to 6 nautical miles) to screen it to prevent the entrainment of eels. After 1 January 2015, it will become an offence not to have a screen on any such intake or outfall, unless the Environment Agency/NRW have specifically issued notice to exempt the requirement.

In addition the Environment Agency/NRW can require the provision of fish passes and screens for the protection of salmon and migratory trout (sea trout or sewin) under the Salmon and Freshwater Fisheries Act 1975 (6).

4.3. UK ABWR Assumptions

The following assumptions have been made in the development of Hitachi-GE's approach to addressing the GDA requirements relating to water use and abstraction:

i. The generic site is a coastal site and seawater cooling is adopted;

ii. The GDA submission is based on a nuclear power plant comprising one UK ABWR reactor;

iii. Cooling water flow is based on 12°C temperature uplift;

iv. Specifics of inlet and outfall design are a site-specific matter, to be addressed at permit application;

v. All freshwater is supplied by the local water company, either direct from reservoirs, or from their potable water supply network. This does not preclude the use of other freshwater supply options at specific sites;

vi. Notwithstanding assumption v., the GDA assumes no freshwater is abstracted by the nuclear power plant and no licence is required;

vii. The construction phase is excluded from the GDA;

viii. Decommissioning is excluded from the conventional GDA submission.

4.4. UK ABWR Fresh water requirements

Fresh water will be used for drinking, washing and showering by personnel, fire protection and component cleaning as part of the Domestic Water System. Fresh water is also de-ionised for component cooling and decontamination etc. as part of the Makeup Water Purified System.

As stated above, the source of the generic site's freshwater water is assumed during GDA to be the local water company. Other potential sources of fresh water could be used; this will be a site-specific decision dependant on the availability of local freshwater sources. Potential sources may include desalinated water, fresh surface water abstraction and groundwater abstraction. A site-specific assessment of constraints will have to be made as part of abstraction licence applications.

The assumption about the source of the freshwater means that the nuclear power plant operator will not require an abstraction licence for freshwater. Note that the need to obtain an abstraction licence at the site-specific permit application stage will need to be reviewed if the water supply arrangements change.

Freshwater intake rates at the UK ABWR generic site will be during different operating regimes (i.e. start-up/commissioning, normal operation, outage etc). For GDA, the total freshwater intake requirements of the UK ABWR under the following operating conditions will be estimated (N.B. construction and decommissioning have been excluded from the conventional GDA):

- Commissioning/start-up;
- Routine operation;
- Outage.

4.5. UK ABWR Cooling Water requirements

The UK ABWR will use seawater for once-through cooling in the main steam condenser, and once-through cooling of other reactor and turbine components.

4.5.1. Cooling systems

The cooling systems of the ABWR can be broken down into the Circulating Water (CW) system, the Turbine Building Service Water System (TSW), Turbine Building Cooling Water System (TCW), Reactor Building Service Water System (RSW) and Reactor Building Cooling Water System (RCW). A description of the following cooling water systems (in brief, referencing out to the main Hitachi-GE UK ABWR GDA Reference design (in preparation) will be provided. The CW, TSW, TCW, RSW and RCW descriptions will include:

- The purpose of the system;
- The components cooled;
- Thermal load;
- Seawater requirements under routine and other operating conditions.

N.B. it should be noted that these flow estimates will be initial estimates, and may be altered in response to site-specific conditions and/or the outcome of detailed modelling.

A discussion of the potential cooling system options will be made available, having reference to the BREF Note (Integrated Pollution Prevention and Control Reference Document on the Application of Best Available Techniques to Industrial Cooling Systems, December 2001) (7) (referenced from the P&ID Document) and the Environment Agency Cooling Water Options at Nuclear Power Stations Review (8). The exact details of the cooling system will be defined at site-specific permitting. Potential cooling options that will be considered include:

- Once through cooling using sea, estuary, river, or lake as the heat sink;
- Once-through cooling using cooling towers to cool water before discharge to sea, estuary, river, or lake;
- Recirculation system using natural draft cooling towers;
- Recirculation system using mechanical draft cooling towers;
- Closed-circuit dry air cooled systems;
- Closed-circuit wet cooling;
- Hybrid wet/dry cooling systems (closed or open circuit).

The range of cooling options available means that potential sites for an UK ABWR in the UK include coastal, estuary and inland locations. However, as the generic site is a coastal site (9), once-through seawater cooling has been adopted for GDA. This does not preclude other sites opting for different cooling options at site-specific application stage.

The seawater intake will be screened to remove debris and the disposal route for the collected debris will be defined at site-specific permitting. The design of the CW, TSW and RSW systems will include control measures to prevent fouling (i.e. physical, chemical, mechanical). This is covered further in section 5 Discharges to Surface Waters.

Inlet and outlet structures for the system will need to be sited and designed to reduce the potential for sediment mobilisation and scour on the sea bed, and inlet structures need to be sited to minimise impact on surrounding habitats and species. These factors are highly site-specific and again will be addressed at

site-specific permitting.

4.5.2. Fish deterrent & return schemes

As the design of fish deterrent and return systems is highly site-specific and full design of the system will be considered at site-specific permitting. At this stage however, a number of options can be considered and taken forward to the full site-specific options assessment and selection.

Measures that may be adopted as part of the system to reduce fish impingement and entrainment include:

- Design of inlet location and structure to minimise intake velocities;
- Use of physical barriers, including various designs of bar screens and drum screens modified for fish return;
- Use of behavioural barriers including electric, bubble, light, and sound barriers.

Any approach undertaken will be compliant with the requirements of the Eels Regulations (3) as appropriate.

5. Discharges to Surface Waters

5.1. P&ID Requirements

The Environment Agency has identified the information they require to carry out the GDA in the P&ID (1). The P&ID requirements relating to discharges to surface waters are reproduced below:

Provide a description of how aqueous waste streams will arise, be managed and be disposed of throughout the facility's lifecycle. Include:

- *Sources and quantities of contaminants (including disinfectant and biocides), highlighting any priority substances (as specified in the 'Priority Substances' Directive (EU, 2008));*
- *Identification of the effluent and surface water runoff streams contributing to the overall discharge and how they are controlled;*
- *Potential options and associated environmental impact for disposal of each individual effluent stream;*
- *The means of control in the event of detection of unplanned radioactive or other contamination of the discharge;*
- *Options for beneficial use of the waste heat produced;*
- *Environmental impact of thermal discharges.*

5.2. Regulatory context

Discharges of trade effluent (which encompasses all non-radioactive effluents generated at the generic site) to controlled waters (which include coastal waters out to the territorial limit) require a permit under the Environmental Permitting (England and Wales) Regulations 2010 (SI 2010 No.675), as amended (10).

The nuclear power plant operator will have to apply for an Environmental Permit at the site-specific permit application stage. The permit application will include information on the source of the effluent, identify the flow rate and contaminants in the effluent (including heat) and assess the impact of the releases on the receiving environment, including specific assessment of the impact on EU Habitats sites and nationally designated sites and species.

At the GDA stage, the P&ID requires the requesting party to provide information on proposed discharges to surface water in order to demonstrate that the UK ABWR can operate within the requirements of the UK

regulatory requirements. The approach undertaken by Hitachi-GE draws upon the relevant parts of the Environment Agency's guidance (11).

5.3. UK ABWR Assumptions

The following assumptions have been made in the development of Hitachi-GE's approach to addressing the GDA requirements relating to discharges to surface waters:

i. The generic site is a coastal site and once-through seawater cooling is adopted.

ii. The GDA submission is based on a nuclear power plant comprising one UK ABWR reactor.

iii. Cooling water flow is based on 12°C temperature uplift.

iv. Specifics of inlet and outfall design are a site-specific matter, to be addressed at permit application.

v. It is assumed that the UK ABWR will use physical methods to control fouling. Site specific requirements for biocide dosing, and associated environmental impacts, will be evaluated at site-specific permit application.

vi. All freshwater is supplied by the local water company either direct from reservoirs or from their potable water supply network. This does not preclude the use of other freshwater supply options at specific sites, depending on the availability of local water supply sources.

vii. There is one combined discharge with thermal load (above background).

viii. The construction phase is excluded from the GDA.

ix. Decommissioning is excluded from the conventional GDA submission.

5.4. UK ABWR Aqueous waste stream arisings

5.4.1. Effluent Characterisation

As part of the GDA, the aqueous effluent streams generated from the ABWR at the generic site will be identified and detailed under routine as well as other operating conditions. This will include a description of their source and the volumes/flow rates of effluents arising during commissioning/start-up, routine operation and outage will be estimated, as far as is practicable. (N.B. construction and decommissioning have been excluded from the conventional GDA).

Information on the flow rates and composition of each effluent stream will be sourced firstly from Hitachi-GE design specifications and information, and other relevant information sources as necessary, such as ABWR operational experience, ABWR licensing applications, other licensing and permitting experience, other publicly available information, guidance, common practice at nuclear power stations and identified assumptions, as available.

Key effluent streams identified to date which will be described may include:

- Circulating water discharge;
- Turbine Building service water discharge;
- Reactor Building service water discharge;
- Main water treatment plant deioniser regeneration and back-wash effluent;
- Boronated water from Standby Liquid Control system (SLC) maintenance;
- Liquid waste treatment system effluents (treated High Conductivity Waste System (HCW) effluents);
- Decontamination process effluents (treated in the liquid waste treatment system);

- Laundry drain effluent;
- Hot shower drain effluent;
- Controlled area drain effluent;
- Non-radioactive drain effluent;
- Site drainage; and,
- Site sanitary effluent/sewage.

N.B. Radioactive effluents and discharge routes are separately identified in the Demonstration of Best Available Technique (BAT) (13).

The main likely contaminants in each effluent stream will also be identified, i.e. biocides, disinfectants, corrosion inhibitors, other contaminants (including heat) and quantified as far as possible. Any likely contaminants which are listed in the 'Priority Substances' Directive (12) will be identified. Information on likely non-radioactive contaminants will also be presented, with appropriate caveats made regarding assumptions around the prospective operator's operating approach, in order to further develop estimates of likely contaminant loads in effluent streams.

Measures to control site drainage and reduce the potential for a drainage stream or effluent stream to become contaminated (both radioactive where this is a risk, and non-radioactive contamination) will be discussed for each drainage/effluent stream, where such measures are readily identifiable.

The general controls to prevent the discharge of potentially polluted effluents (both radioactive and non-radioactive) to the environment will be identified (this may well need to be developed further at site-specific permit application).

5.4.2. Effluent treatment and associated environmental impact for disposal of individual effluent stream

Through use of appropriate assessment, the GDA submission will identify reasonably practicable effluent treatment options for each effluent stream (or group of effluents), and identify the relative environmental impacts of the treatment options (where viable options are identified) as a qualitative comparison. This will show options considered for each effluent stream (or group of effluents) and the broad environmental impacts of each treatment option.

Quantified data on contaminant concentrations and effluent discharge flows will be used as an input into the tool to give predicted maximum concentrations of contaminants in the receiving water after initial mixing. These values will be compared against environmental quality standards (EQSs) for each contaminant (where published limits exist) and an assessment made as to whether the discharge of each individual substance is regarded as insignificant or potentially significant.

Further detailed modelling of potentially significant discharges will be carried out as part of the site-specific assessment. This level of modelling and assessment is more appropriate to site-specific permitting where potential impacts and their associated mitigation measures at the site can be identified more confidently. This approach has precedence in the GDA process as the approach adopted by Areva in their GDA submission.

5.4.3. Impact of thermal discharges

Cooling water discharge may generate a large thermal plume, which can directly affect fish and other species in the receiving water body, as well as presenting a barrier to migratory species. However complete assessment of the environmental impact of reactor discharges requires accurate information on the behaviour of the receiving waters and how they interact with the various substances to be discharged. This can only be achieved by computational dispersion modelling, using localised monitoring data from the actual site.

Hitachi-GE therefore proposes that no thermal dispersion modelling is carried out at GDA on the basis that assessing the impact of thermal dispersion is highly site-specific and, as a consequence, the thermal impact of discharges will be assessed in detail at site-specific permitting using site-specific dispersion modelling.

5.4.4. Options for the Beneficial Use of Heat

There are a number of potential options for the beneficial use of power cycle waste heat. A summary of the advantages and disadvantages of each option will be presented, but at this stage of GDA no firm proposals can be made; any heat recovery techniques will be a site-specific matter. Potential options which could be considered may include:

- District heating;
- Crop growing;
- Fish farming;
- Heating of road surfaces;
- Heating for algae biodiesel growth; or
- Desalination.

6. Discharges to Groundwater

6.1. P&ID Requirements

The Environment Agency has identified the information they require to carry out the GDA in the P&ID (1). The P&ID requirement relating to discharges to groundwater is reproduced below:

If there will be discharges to groundwater, describe the nature and quantity of those discharges and provide an assessment of the impact on groundwater.

(Note:

1. *You should address prevention of accidental discharges of radioactivity to land and groundwater in your response to item 4 above.*
2. *We do not normally permit discharges to groundwater.)*

6.2. Regulatory context

Discharges to groundwater are controlled by the Environmental Permitting Regulations (England and Wales) Regulations 2010 (SI 2010 No.675) (EPR 2010) (10), which make it an offence to cause or knowingly allow a groundwater activity to take place without an environmental permit or an exemption. Groundwater activities include the discharge of a pollutant which results in the direct or indirect input of the pollutant to groundwater.

6.3. UK ABWR Assumptions

The following assumption has been made in the development of Hitachi-GE's approach to addressing the GDA requirements relating to discharges to groundwater:

i. Hitachi-GE has assumed that there will not be any intentional discharges to groundwater at the generic UK ABWR site.

6.4. UK ABWR Discharges to Groundwater

The UK ABWR design does not include any requirement for routine discharges to groundwater. As a preventative measure, each building that contains radiation controlled areas has a roof drainage system.

Rainwater is guided by the drainage system to a seal pit and then discharged to the environment with cooling water. Therefore no rainwater is directly discharged to the groundwater.

6.5. Measures to Prevent Accidental Discharges to Groundwater

The UK ABWR design will utilise BAT to prevent accidental leaks and spills of non-radioactive pollutants, which could give rise to accidental pollution of land and groundwater (13). These will comprise physical measures including:

- Tank bunding and secondary containment of potentially polluting substances;
- Hard surfacing areas of potential spills risk (e.g. loading areas);
- Use of oil interceptors on drainage systems;
- Provision of spill kits; and,
- A Plumbing and Drainage System (P&D) to collect and segregate potential leaked water (e.g. firewater water run-off).

In addition, occurrence of such events will be minimised through various measures including:

- Staff training in spills prevention and emergency response;
- Emergency response exercises;
- Vehicle routing;
- Delivery and off-loading operational instructions; and,
- Inspection and preventative maintenance programmes for structures providing pollution prevention functions.

7. Operation of Installations (combustion plant and incinerators)

7.1. P&ID Requirements

The Environment Agency has identified the information they require to carry out the GDA in the P&ID (1). The P&ID (1) requirement relating to operation of installations including combustion and incineration is reproduced below:

1. *Identify what combustion plant (for example, for standby generation or auxiliary boilers) will be provided.*
    - *If the aggregate rated thermal input of all combustion plant is greater than 50 MW, provide a comparison of the proposed technology against our sector guidance.*
    - *If the aggregate rated thermal input of all combustion plant is greater than 20 MW, describe how greenhouse gas emissions will be monitored.*
2. *If the design includes an on-site incinerator with a capacity or 1 tonne or more per hour, provide a comparison of the proposed technology against our sector guidance.*

7.2. Regulatory context

Combustion activities are controlled under the Environmental Permitting Regulations (England and Wales) Regulations 2010 (SI 2010 No.675) (EPR 2010) (10), as amended by the Environmental Permitting Regulations (England and Wales) (Amendment) Regulations 2013 (SI 2013 No.390) (EPR 2013) (14). The EPR 2013 came into force on 6th April 2013 and transpose Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control) (the Industrial Emissions Directive, IED) (15).

Schedule 1, Part 2, Chapter 1, Section 1.1 of the EPR 2010 (as amended by EPR 2013) identifies the combustion activities which come under the Regulations. This listing includes the following relevant activities:

1. *1.1 Part A(1) (a) Burning any fuel in an appliance with a rated input of 50 of more megawatts.*

The interpretation provided below section 1.1 states:

2. *For the purposes of Part A(1) (a) of this section, where 2 or more appliances with an aggregate rated thermal input of 50 megawatts or more are operated on the same site by the same operator those appliances must be treated as a single appliance with a rated thermal input of 50 megawatts or more.*

The nuclear power plant operator will have to apply for an Environmental Permit (which can be combined with the water discharge Environmental Permit) for combustion plant at the site-specific permit application stage, as the aggregated thermal input of the auxiliary boilers and diesel generators at the site is greater than 50 MWth.

Directive 2003/87/EC (16) established the EU Emissions Trading Scheme (EU ETS), a greenhouse gas emissions trading scheme, which works on the 'cap and trade' principle. A 'cap', or limit, is set on the total amount of certain greenhouse gases that can be emitted by the factories, power plants and other installations in the system. The cap is reduced over time so that total emissions fall. Within the cap, companies receive or buy emission allowances which they can trade with one another as needed. After each year a company must surrender enough allowances to cover all its emissions, and any spare allowances can either be kept to cover future needs or they can be sold.

The EU ETS has just entered its third phase (2013-2020), and Commission Regulation (EU) No. 601/2012 (17), sets out rules for the monitoring, reporting and verification of emissions of greenhouse gases.

The main legislation controlling incineration plant in the UK is the Environmental Permitting (England and Wales) Regulations 2010 (SI 2010 No.675) (10), as amended by the Environmental Permitting Regulations (England and Wales) (Amendment) Regulations 2013 (SI 2013 No.390) (14). The EPR 2013 came into force on 6th April 2013 and transpose Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control) (the Industrial Emissions Directive, IED) (15).

A waste incinerator burning non-radioactive wastes may come under Schedule 1, Chapter 5, Section 5.1 of the EPR 2013, as it amended EPR 2010. Section 5.1 contains the following listing of relevant activities:

5.1 Part A(1) (a)	*The incineration of hazardous waste in a waste incineration plant or waste co-incineration plant with a capacity exceeding 10 tonnes per day.*
5.1 Part A(1) (b)	*The incineration of non-hazardous waste in a waste incineration plant or waste co-incineration plant with a capacity exceeding 3 tonnes per hour.*
5.1 Part A(1) (c)	*The incineration, other than incidentally in the course of burning landfill gas or solid or liquid waste, of any gaseous compound containing halogens.*
5.1 Part A(2)	*Deleted from the regulations*
5.1 Part B (a)	*The incineration in a small waste incineration plant with an aggregate capacity of 50 kilogrammes or more per hour of the following wastes:*

Wastes are then listed including vegetable wastes, cork wastes, wood and animal carcasses. Waste incineration plant which fall into one or more of these relevant activities will require and Environmental Permit to operate.

Waste incinerators burning solely radioactive wastes do not come under Schedule 1, Chapter 5, Section 5.1, but are a radioactive substances activity and fall under Schedule 23 of EPR 2010 and will require an Environmental Permit to operate.

7.3. UK ABWR Assumptions

The following assumptions have been made in the development of Hitachi-GE's approach to addressing the

GDA requirements relating to the operation combustion and incineration installations:

i. The ABWR design does not include any requirement for on-site incineration and Hitachi-GE have assumed that there will not be a waste incineration installation at the generic UK ABWR site.

ii. Combustion plant at the generic site comprise two auxiliary boilers, each with a gross rated thermal input of 13.1 MWth, three standby diesel generators, each with a gross rated thermal input of 14.6 MWth and a back-up diesel generator of 14.6 MWth gross thermal input.

iii. Diesel firewater pumps and other minor local combustion plant (e.g. isolated space-heating boilers) are trivial and are not considered further in GDA.

iv. The auxiliary boilers discharge through separate stacks (i.e. not in a common windshield).

v. Each diesel generator separately discharges via silencers and short vertical stacks on the top of the reactor building.

vi. The GDA submission will not require a Site Condition Report, or assessment of accidents (accident risk assessment is not included in the sector guidance).

vii. Emissions data from Japanese operational plants will be utilised for the modelling and assessments.

7.4. UK ABWR Incineration Plant Installation

As outlined above, the ABWR design does not include any requirement for on-site incineration and Hitachi-GE have assumed that there will not be a waste incineration installation at the generic UK ABWR site. This P&ID requirement is therefore not addressed further in this document.

This does not preclude a future UK ABWR operator from seeking to operate a waste incinerator at a UK ABWR site; however, they will have to comply with the requirements of relevant legislation in force at the time of application and operation of the incinerator.

7.5. UK ABWR Combustion Plant Installation

The scope of the Environmental Permit installation will be defined to allow modelling and assessment to be carried out. This is currently envisaged to include:

- Three standby diesel generators (each rated at 14.6 MWth gross thermal input), each with a stack;
- One emergency diesel generator (rated at 14.6 MWth gross thermal input), with a stack;
- Two auxiliary diesel-fired boilers (each rated at 13.1 MWth gross thermal input), each with a stack and housing;
- Cooling systems and any associated water dosing systems;
- Diesel fuel storage tanks (day tanks and storage tanks for each combustion unit);
- Boiler water treatment system;
- Raw materials storage; and,
- Abatement systems, if required/practicable (22).

Ultimate selection of this plant for the UK ABWR will follow a review of the latest available combustion plant equipment available in Europe, with each selection underpinned by a BAT Assessment. This will not, however, be carried out during GDA timescales, therefore emissions data from Japanese operational plant will be utilised for the modelling and assessments as part of the GDA process.

7.6. Comparison with the Combustion Sector Guidance Note

The following approach will be taken to preparing the comparison against the Combustion Sector Guidance Note (CSG) (18). N.B. The CSG notes that the sector guidance is to be applied in addition the more general guidance for industrial activities provided in 'How to comply with your environmental permit' (HCEP) (19); there relevant requirements will therefore also be taken into account.

- The Environmental Permit installation will be defined, as outlined above.
- A comparison of the proposed design and operation of the combustion plant (auxiliary boilers, diesel generators and supporting equipment) against the indicative BAT requirements identified in the Sector Guidance Note (and, by extension HCEP) will be provided. Key sections of the comparison (following the order they are identified in the CSG and HCEP) are listed below. Requirements from HCEP are shown in brackets or identified in the text. The key sections that will be addressed are:
    - Energy efficiency;
    - Efficient use of raw materials and water (HCEP);
    - Avoidance, handling, recovery or disposal of wastes;
    - Point-source emissions to water – including controls on fuel and raw material storage, and handling and treatment of process effluents including de-ionization effluent, boiler water blow-down and cleaning water;
    - Point-source emissions to air – including emission control in design (primary control measures) in-process controls and consideration of abatement technologies for NOx, SOx, CO, VOCs and particulate control. HCEP requires operators to assess the dispersion capability of their vent and chimney heights and make an assessment of the fate of the substances emitted to the environment – this will be discussed in the impact assessment section (section 8.6.1);
    - Fugitive emissions – control of fugitive emissions to air, water, groundwater and ground.
    - Monitoring – this includes monitoring requirements and a requirement to meet the indicative benchmark standards for emissions except in justifiable circumstances.
    - General management, including having a written management system, responsible persons, training and records (HCEP);
    - Site security (HCEP);
    - Control of odour, noise and vibration (HCEP).

7.6.1. Impact assessment

The HCEP requires operators to assess the dispersion capability of their vent and chimney heights and make an assessment of the fate of the substances emitted to the environment. Assessment of the dispersion capability of vent and chimney heights, along with the fate of the substances typically emitted to the environment under normal operating conditions, will be made by using the Environment Agency D1 assessment tool. The impacts of combustion gas emissions from the boilers and diesel generators will be made using the Environment Agency's H1 assessment tool (N.B. the argument underpinning the use of diesel generators can be found in the wide PCSR submission. In summary, these plants are only to be used in emergency situations; reliability is the key consideration, in conjunction with the assessment of the impact on the surrounding environment).

7.7. Greenhouse Gas Emissions Monitoring

The proposed approach to monitoring greenhouse gas emissions will meet the requirements contained in Guidance Document (MRR No 1): The Monitoring and Reporting Regulation - General guidance for installations. (20), which provides guidance on the implementation of Commission Regulation (EU) No. 601/2012 (17). It is not proposed however, that a detailed Monitoring Plan will be developed, as this is more appropriately developed by UK ABWR operators.

The development of the monitoring approach will include consideration on the most appropriate monitoring approach (e.g. the standard method), and consider the approach to data collection, identified in the Guidance Document (MRR No 1) (20).

8. Substances subject to the Control of Major Accident Hazards

8.1. P&ID Requirements

The Environment Agency has identified the information they require to carry out the GDA in the P&ID (1). The P&ID (1) requirement relating to COMAH legislation is reproduced below:

Identify any need for on-site storage of substances above the qualifying thresholds in COMAH99.

If a threshold is exceeded, describe the measures taken in the design to prevent a major accident to the environment.

8.2. Regulatory context

The Control of Major Accident Hazards Regulations 2005 (21) (22) (the COMAH Regulations) apply to establishments which keep (or transport) listed substances in quantities exceeding identified thresholds. The COMAH Regulations specify two threshold quantities for each listed substance or risk category of substance: the lower quantities are the threshold for lower tier COMAH sites, the higher quantity is the threshold for top tier COMAH sites. The COMAH Regulations do not cover radioactive materials.

Operators of establishments covered by the COMAH Regulations have a general duty to take all necessary measures to prevent major accidents and to limit their consequences, and report any major accidents to the competent authority. They must prepare a ‘Major Accident Prevention Policy’ which should demonstrate that an adequate safety management system is in place to prevent major accidents. The enforcing authority should be sent details (’notification’) of the name and address of the operator, the address of the site, identify who is in charge, and details and amounts of dangerous substances held at the site. Any changes in these details should be notified to the authority. If the site is a top tier site, additional requirements apply.

8.3. UK ABWR Assumptions

The following assumptions have been made in the development of Hitachi-GE’s approach to addressing the GDA requirements relating to COMAH:

i. The GDA Submission is based on one UK ABWR reactor at the generic site.

ii. The quantities of substances stored at a UK ABWR site during commissioning, routine operations and outage are below the COMAH qualifying thresholds.

8.4. Quantities of COMAH Substances Present at the UK ABWR

In order to identify whether a UK ABWR station is likely to come under the COMAH Regulations, available information on the storage of COMAH-listed substances stored on ABWR sites has been compared with the thresholds listed in the COMAH Regulations.

Data on materials storage at ABWR sites was collected from:

- Hitachi-GE information on materials storage at Japanese Nuclear Power Plant;
- Available information from licensing applications for ABWR sites; and,
- UK operating experience and proposed operating philosophy by the operator.

The quantities of COMAH-listed substances to be stored on a UK ABWR site were compared with applicable COMAH qualifying thresholds (for named substances and generic risk-phrase groups and in aggregation).

8.4.1. Applicability of the COMAH Regulations

It has been assessed that COMAH will/will not apply to the UK ABWR at the generic site. This P&ID requirement is therefore not addressed further in this document.

8.5. Further development of COMAH requirements at site-specific permitting stage

The following key areas will need to be addressed at site-specific permitting:

- Review quantities of materials present on the site-specific UK ABWR against COMAH thresholds and aggregation rules to determine whether COMAH applies, bearing in mind that the quantities of substances stored at a multi-reactor site will be greater than those proposed for the single-reactor GDA site; and,
- Further actions will be required to address COMAH requirements if COMAH applies.

9. Conclusion

It is important to note that much of the conventional environmental impact assessment work is heavily reliant on site-specific data and so will necessarily fall out of the scope of the GDA assessment. Hitachi-GE is, however, committed to addressing as many requirements as possible in the design stage to mitigate effects where feasible. The assessments that are suitable for completion within GDA will be undertaken at the appropriate stage, with the results fed back into both the BAT assessments and the design process itself where appropriate, in order to ensure the design is fully optimised.